REMARKS

The Official Action of March 6, 2007 and the prior art relied upon therein have been carefully reviewed. The claims in the application are now claims 1-12, including presently non-elected and withdrawn claim 4, the latter of which is hereby authorized to be deleted by Examiner's Amendment upon allowance of the other claims. Applicants respectfully maintain that their claims define novel and unobvious subject matter for reasons pointed out below, and therefore should be allowed. Favorable reconsideration and allowance are therefore earnestly solicited.

New claims 6-12 are added above, and these claims define patentable subject matter at least for the reasons that they depend directly or ultimately from claim 1, and thus incorporate the subject matter of claim 1. Claim 6 finds support at page 4, line 15. Claim 7 finds support at page 5, lines 19-22. Claim 8 finds support at page 7, lines 22-23. Claims 9-11 finds support at page 9, lines 24-25. Claim 12 finds support at page 9, last line.

The typographical error in claim 1, helpfully noted by the examiner, has been corrected above.

Claims 1-3 and 5 have been rejected under §103 as obvious from Harayama et al 6,054,225 (Harayama) in view of

Shimizu 2002/0060159 (Shimizu). This rejection is respectfully traversed.

Claim 1 recites: "A composite chromium plating film containing hard particles in network-shaped microcracks, said microcracks having a surface-occupying ratio 10 to 20% by area and a distribution density of 1,200 to 2,500/cm, and the amount of said hard particles being 1 to 15% by mass per 100% by mass of the entire plating film."

Distinguishing features of the claimed invention are found in that the composite chromium plating film contains hard particles in network-shaped microcracks in an amount of 1 to 15% by mass per the entire plating film, where the microcracks have a surface-occupying ration of 10 to 20% by area and a distribution density if 1,200 to 2,500/cm, thereby making it possible to maintain excellent wear resistance and scuffing resistance due to the microcracks, while at the same time providing only low attacking against a mating member, even though the surfaces are worn by sliding (see page 5, lines 10-14 in paragraph [0013] of the specification).

In contrast to the claimed invention, Harayama discloses a composite chromium plating film containing hard particles in a network of cracks formed in a hard chromium plating film, where the hard particles are spherical and the average size of the hard particles is 0.7 to 10μm, and the

dispersion ratio of the hard particles is 3 to 15 percent by volume (see column 2, lines 22-27 of Harayama).

Although Harayama teaches, as the examiner indicates in lines 2-3 of Paragraph 7, that the crack density is in a range from 0 to 200 lines per millimeter (namely, 0-2,000 lines per centimeter) Harayama states in column 2, lines 44-45 thereof, that: "When crack density is high, the strength of the plating film decreases and conversely when the crack density is low, a high dispersion ration of hard particles cannot be obtained. The preferred range of crack density in this invention is from 40 to 90 lines per millimeter." (see column 2, lines 45-50 of Harayama).

Harayama thus does not teach or suggest how to increase the crack density. In fact, Harayama teaches away from such a high density, whereby applicants have flown in the face of Harayama.

In this regard, it has been considered that even though the distribution density of microcracks can be increased to about 2,000/cm by the conventional plating method using a sergent bath or silicofluoride bath, a plating film thus obtained has microcracks with a homogeneous distribution density, and part of the plating film has low strength and relatively poor wear resistance, resulting in difficulty to put such plating films into commercial practice. (see paragraph [0005] of the present specification).

In contrast to Harayama, the applicants not only have confirmed that by the production method of composite chromium plating film as described, e.g. in the specification of the present application at paragraphs [0026] and thereafter, it is possible to form a composite chromium plating film having network-shaped microcracks which are uniformly formed on the surface of the plating film at a distribution density of 1,200 to 2,500 lines per centimeter and a surface-occupying ratio of 10 to 20% by area, far in excess of anything preferred by Harayama. Still, applicants' composite chromium plating film as such maintains sufficient practical strength, and also applicants have found that in a case where the composite chromium plating film as such contains hard particles in microcracks in an amount of 1 to 15% by mass per the entire plating film, it is possible to lower attacking ability to a mating member with increasing wear resistance and scuffing resistance and without deteriorating the film strength per se, and thus the present invention has been accomplished by these findings (see paragraphs [0012] and [0013] of the specification).

The graph in Fig. 3 of the present application shows the relation between the density of microcracks and a self-wear index. This graph demonstrates that when the surface-occupying ratio of the microcracks and the content of hard particles in the composite chromium plating film are in the range as recited in claim 1 of the present application, the self-wear index is

significantly decreased at a boundary line of the density of microcracks as defined in the present invention, which makes it possible to significantly increase the wear resistance of the plating film.

On the other hand, Harayama clearly describes, as mentioned above, that when crack density is high, the strength of the plating film **unfavorably decreases** and the **preferred range of crack density is only from 40 to 90 lines per millimeter.** Harayama does not disclose, teach or suggest any complete method to increase the crack density by the range of density of microcracks as defined in the present invention. Also, Harayama does not teach the effect which improves the sliding properties such as wear resistance, etc. in the range of density thereof.

Accordingly, even if Harayama could be correctly interpreted as broadly describing a crack density partly overlapping with that of the present invention, the adoption of the range of the crack density as such, which Harayama considers to be unfavorable, those skilled in the art at the time the present invention was made would have been inhibited from reaching the range as defined in the present invention because of the negative comments of Harayama.

Also, Shimizu discloses a chrome-plated sliding member having a hard chrome plating film comprising at least two hard chrome plating layers provided on an area to serve as a sliding surface of the interface with a substrate, wherein microcracks

open to the outer surface side of the hard chrome plating layers distributed in the individual hard chrome plating layers (see page 2, paragraph [0020], lines 1-7 of Shimizu). Further, Shimizu teaches that quantities of microcracks as expressed by area ratios of microcracks in a cross-section of the hard chrome plating film comprise a quantity of the portion where the crack stops within the layer containing the opening thereof within a range of from 1.5 to 35.0%, a quantity of the portion where the crack propagates into the hard chrome plating layer under the layer containing the opening thereof within a range of from 0.5 to 25.0%, and a total quantity of microcracks within a range of from 2.0 to 40.0% (see page 2, paragraph [0020], lines 12-21 of Shimizu).

However, Shimizu does not entirely teach or suggest any value of the crack density or those effects produced by the crack density in any specific range thereof.

Therefore those skilled in the art referring to Harayama and Shimizu at the time the present invention was made would not have been motivated to reach a composite plating film containing hard particles in network-shaped microcracks, such microcracks having a surface-occupying ratio of 10 to 20% by area and a distribution density of 1,200 to 2,500/cm, and the amount of said hard particles being 1 to 15% by mass per 100% by mass of the entire plating film, by modifying Harayama with the teaching of Shimizu, or by optimizing the microcrack surface-occupying

ratio of Harayama in view of the teaching of Shimizu. Accordingly, claim 1 of the present application would not have been obvious over Harayama even though combined with Shimizu.

Applicants respectfully wish to return to the apparent contradiction between Harayama and Shimizzu, which applicants believe and submit would have made quite unobvious any possible combination of the two references in any way leading to the present invention. Harayama clearly states at column 2, commencing at line 45 that when "crack density is high, the strength of the plating film decreases", and that the "preferred range of crack density in this invention is from 40 to 90 lines per millimeter." In view of this teaching, and even interpreting Shimizu in the most favorable way to the rejection, the increase in microcracks open to an uppermost surface cannot reasonably exceed what Harayama teaches against.

Withdrawal of the rejection is in order and is respectfully requested.

The prior art documents made of record and not relied upon by the PTO have been noted, along with the implication that such documents are deemed by the PTO to be insufficiently material to warrant their application against any of applicants' claims.

Applicants believe that all issues raised in the Official Action have been addressed above in a manner that should

lead to patentability of the present application. Favorable consideration and early formal allowance are respectfully requested.

Respectfully submitted,

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